One new subject introduced is the symmetry of systems, which is really a summary of the work of P. Curie, and English readers will be thankful for having so easy a means of acquiring a knowledge of this important subject.

The book does not pretend to be an encyclopædia of physics, but it treats of the whole subject so as to bring students up to a standard when they can feel confident in taking up research on some definite subject. In other words, it meets the requirements of the standard of the Honours B.Sc. Examination. The whole book is clearly written, and teachers will have no hesitation in leaving students alone with it.

Another excellent feature is the treatment of a gravitational field first, and then later an electrostatic field where it is only necessary to give analogies with the former case. Here, generally, the Cartesian notation is used, but the Vector notation is explained without much use being made of it.

One of the most striking drawbacks of the book is the lack of an index. J. R.

LOGIC, TEACHING AND PRACTICE IN MATHEMATICS.

(1) *The Algebra of Logic.* By Louis Couturat. Authorised English Translation by Lydia G. Robinson. With a Preface by P. E. B. Jourdain. Pp. xiv+98. (London and Chicago: The Open Court Publishing Company, 1914.) Price 3*s.* 6*d.* net.

(2) *An Algebra for Preparatory Schools.* By Trevor Dennis. Pp. viii+155. (Cambridge University Press, 1913.) Price 2*s.*

(3) *Test Papers in Elementary Algebra.* By C. V. Durell. Pp. viii+233. (London: Macmillan and Co., Ltd., 1914.) Price 3*s.* 6*d.*

(4) *Practical Mathematics for Technical Students.* Part I. By T. S. Usherwood and C. J. A. Trimble. Pp. 370. (London: Macmillan and Co., Ltd., 1914.) Price 3*s.* 6*d.*

(5) *A Text-book on Spherical Trigonometry.* By Prof. R. E. Moritz. Pp. vi+67. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1913.) Price 4*s.* 6*d.* net.

(6) *Plane and Spherical Trigonometry* (with Five-Place Tables). By Prof. R. E. Moritz. Pp. xvi+357+67+96. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1913.) Price 10*s.* 6*d.* net.

(1) THIS is an excellent translation of M. Couturat's well-known "Algèbre de la Logique." The conciseness and modernity of M. Couturat's book is very apparent when we compare it with the first two volumes of Schröder's bulky, prolix, and somewhat antiquated work. The book under review is, as is remarked in the preface (p. viii.; *cf.* pp. 92–93), an exposition of the beautiful and simple calculus of symbolic logic, regarded as a branch of universal algebra. Leibnitz distinguished the two most important aspects of a symbolic language designed for purposes of reasoning, under the names *calculus ratiocinator* and *characteristica universalis*: the latter indicates broadly the route taken by Frege, Peano, Russell, and Whitehead; the former the route taken by Boole, Jevons, Venn, Schröder, and others, and is that described in the present work. Between these two routes, the "logic of relations" lies, and this is not dealt with here; but we are given a complete presentation of the important modern work of Whitehead (1898, 1901), Johnson (1901), Poretzsky (1899–1904), and Huntington (1904) on the logic of classes and propositions. Miss Robinson has added several valuable notes to her translation. The volume is neat and handy, and is an important addition to our English mathematical literature.

(2) "The development of the subject is based on psychological rather than logical principles." Here we have a sensible admission of the relation in which a text-book should stand to a scientific treatise, which the text-books of the past helped to obscure. The book consists of a series of graduated papers which exactly follow the lines of the syllabus issued by the curriculum committee of the Headmasters' Conference, and approved by the general committee of the Mathematical Association for all boys, except mathematical specialists, in public schools. There is no "bookwork," and the subject is developed wholly by means of examples; but some attempt has been made to give the pupil an impression of the existence of foundations of the subject and some sense of their nature. The very first question of the book is rather characteristic: "A boy has 5*d.* and is given 3*d.* How much has he now? How much has he if he had 5*d.* and receives x pence? . . .", and so on. The last question of this paper is: "Make up more questions like these and give the answers." This is an excellent way of teaching, and there is a freshness about the book.

(3) This is a collection of papers designed primarily for out-of-school work, and consequently includes only few graphical questions. The papers follow the traditional course of elementary algebra, along the thorny path of quadratics, logarithms, the progressions, combinations, and easy probability, up to the giddy heights of

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mathematical induction and the binomial theorem. The place assigned, as is usual in text-books, to mathematical induction shows how broad is the gulf between psychology and logic. The collection should prove useful.

(4) It is pleasant to read such a practical book as this one. The authors have dealt only with those parts of mathematics which seemed to them to be of real value in practical work, and the whole book is pervaded by the spirit of Prof. Perry. The very form of the questions is refreshingly non-academic: we are concerned with the important things of life—with kilowatts, gearing, and Whitworth standard nuts. It would seem to be a mistake to give (as on p. 257) areas and volumes of certain figures, and then remark:

"The formulæ are proved most conveniently by the aid of more advanced mathematics than need be given in this volume." It warms one's heart to see (p. 5): "*A formula* is practically the simple single statement in general terms of a whole series of particular facts." It seems to us that Prof. Perry and his school are doing much incidentally to help the development of mathematics by opening our eyes to the fact that what Boole called "a premature converse with abstractions" is ruinous for a boy's whole mental life.

(5) Is simply a reproduction of the second part of (6) with a new preface. Whereas the preface of (6) gives a list of the "distinctive features" of the book, (5) states somewhat ambiguously: "Whatever unusual merit the book possesses must be largely sought for in the following points. . . ."

In (6), then, we find that, both in plane and in spherical trigonometry, triangles are solved in detail by graphical methods before analytical methods are presented, and there are many other innovations—thus, Napier's rules are proved and the three fundamental formulæ for the spherical triangle are derived simultaneously. Having read (p. v.): "The references to algebra are limited to those with which every beginner may be reasonably assumed to be familiar," we are surprised to find (p. 278) the imaginary unit defined shortly as the solution of the equation $x^2+1=0$, no evidence having been given that this equation has a solution. After this, we cannot be surprised that there is not the slightest attempt either to point out to the student the very great and fundamental difficulties that there are in the theory of convergence (see especially p. 312) or even to treat the subject correctly. The historical references are sometimes faulty: Wessel was a Dane and not a German; the trigonometrical form of a complex number is due to Euler and not to Cauchy (p. 285).

ф.

OUR BOOKSHELF.

The Schools and the Nation. By Dr. Georg Kerschensteiner. Authorised translation by C. K. Ogden. Pp. xxiv+351. (London: Macmillan and Co., Ltd., 1914.) Price 6*s*. net.

THIS is a book of exceptional interest for all who are engaged in the work of education and for those who are seriously concerned with the future social and economical well-being of the children of the nation.

It is a record of the aims and of the achievements of Dr. Kerschensteiner, of Munich, during the past twenty years in the sphere of continued education for the youth of that city. As a consequence of his assiduous enlightened effort, coupled with the ultimate goodwill of employers and employed, he has been able to establish a complete system of continued trade education for practically all the industries of Munich providing not only for the continued general education up to the close of their eighteenth year of the children leaving the elementary schools, but also for their technical training in industry and commerce combined with instruction bearing upon their daily life and duties and in relation to their future responsibilities as citizens.

The system has been gradually developed, but always in close cooperation with the City Trade Guilds, and its success has been assured by the adoption by the municipality of compulsory measures requiring the attendance of all apprentices and others engaged in employment at the courses provided within the usual working hours.

Special buildings have been erected providing for about fifty-six various industries, chiefly handicraft, many of them demanding much artistic knowledge and skill. This concrete illustration of the successful treatment of the problem of continued education deserves the most serious study.

How Man Conquered Nature. By Minnie J. Reynolds. Pp. v+249. (New York: The Macmillan Company, 1914.) Price 1*s*. 8*d*. net.

THE style of this little book will appeal to children. The language is simple without being babyish. Man's development is traced from the time when, realising the "opposition of the thumb," he threw his first stone, down to his use of a flying machine. Not unnaturally, perhaps, Miss Reynolds, in the first part of the book especially, gives great prominence to woman's part in the civilising process. We are told, for instance, "woman was the first harvester," "the first miller," "the first baker," "the first salt maker," "the first furrier," and so on.

Excelsior School Map of the United States. In four sheets. Size 62 in. by 48 in. (London: G. W. Bacon and Co., Ltd.) Mounted to hang, with rollers and varnished; or mounted, cut to fold, with eyelets. With political colouring, 15*s*.; the same with contour colouring, 16*s*.

THIS wall map is constructed on a conical projection on a scale of 1 : 3,200,000, or 50·5 miles to an inch. It is provided with an inset map of

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